

## ORGANIZATION AND RESULTS OF AGRICULTURAL HOLDINGS REALIZING INVESTMENTS SUBSIDIZED WITH PUBLIC FUNDS

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**Abstract.** In the present article, an attempt was made to assess the organization of production and economic results of agricultural holdings that realized investments subsidized with public funds, from the perspective of good agricultural practice. Agricultural holdings in the Podlaskie voivodeship registered in the FADN system in 2011–2012 were investigated. Assessment accounted for crop structure, stock density, production intensity, the value and structure of capital, and profitability of land, capital, and labour. Analysis showed that holdings benefiting from subsidization of investments with public funds were characterized by greater production intensity and also achieved better economic results. However, they exerted greater pressure on the environment and posed hazards that mainly resulted from high stock density.

**Key words:** agricultural holdings, investments, public funds, organization, income

### INTRODUCTION

One of the more important metrics in assessment of economic condition and developmental perspectives of agricultural holdings is investment activity. The effective and efficient functioning of agricultural holdings is not possible without the introduction of innovative solutions and investment in fixed production factors. The decision to make an investment is most often conditioned by a farmer's personal situation, nevertheless, the

tendency to make investments determined investment – income relationships and is an expression of a pro-developmental or consumption-oriented attitude of the farmer. While modern economic theories emphasize the role of intangible developmental factors, primarily organization and management, as Woś (2000) observes, organization and management require new technologies in and of themselves, which creates demand for investment. An appropriate level of income provides such capabilities. Concentration of resources in a holding leads to an increase in the amount of obtained income. The higher the income, the greater the opportunities to introduce effective innovations in the production process.

Modernization is linked to changes in the organization of holdings and translates into improvement of productivity in the long term. The results of studies conducted by other authors indicate that farmers who modernize their holdings with the contribution of public funds achieve greater productivity and repeat investment activity in the following years (Czekaj, 2008; Czubak and Mikołajczak, 2012; Czubak and Sadowski, 2014; Mańko et al., 2008). Thanks to investments supported by subsidies, much more rapid modernization of holdings and an increase of obtained income took place in EU member states (Kobus, 2009). Holdings benefiting from support of investment with public funds are generally larger and stronger in economic terms and capable of development. Their modernization is linked

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to organizational changes that should be harmonized with the concept of sustainable development, thus they should account for not only economic aspects but also environmental requirements.

The Podlaskie voivodeship is one of the primary beneficiaries of membership in EU structures (Pietrzykowski and Wicki, 2011). Subsidization of agricultural holdings caused an intensification of activities in the scope of their modernization, which in turn, caused diversification of these entities. Modern goods holdings, mainly specializing in dairy production, developed alongside with small holdings. They are capable of generating income at parity level and reproducing production property. They are also the primary beneficiaries of national aid and programmes financed from the EU budget, including for modernization of production.

In the present article, an attempt was made to assess the organization of production and economic results of agricultural holdings that undertook investments subsidized with public funds, from the perspective of compliance with the principles of good agricultural practice, and so, the agricultural practices that ensure sustainable development of agricultural production and protection of natural resources. It was assumed that the economic objective is maximized in these holdings, which may not be neutral to the natural environment.

## MATERIAL AND METHODOLOGY

The research problem was undertaken based on data from agricultural holdings in the Podlaskie voivodeship that participated in the Polish Farm Accountancy Data Network (FADN) in 2011–2012. All holdings benefited from preferential loans and some of them also from subsidies for investment from EU aid funds within the framework of the Rural Development Programme for 2007–2013 (PROW 2007–2013), which justifies the assumption that modernization activity was undertaken. Two groups were distinguished for the purposes of analysis: holdings making investments using subsidies – group I (260 holdings in 2011 and 255 holdings in 2012), and other holdings made up group II (558 holdings in 2011 and 593 holdings in 2012).

Crops structure, stocking density, and intensity of production were accounted for in assessment of the organization of production. The level of consumption of production factors indicates that the environment is burdened by these factors, and this is called tangible

pressure by some authors (Piekut and Machnacki, 2011).

Changes in owned property are also related to investment activity, and these changes were determined based on values of fixed assets, their structure, and indebtedness of holdings. The effectiveness of management (farming) was determined based on profitability of land and labor. Statistical metrics generally used in analyses of this type were used to prepare initial materials (Marszałkiewicz, 1986).

## RESULTS

The holdings subject to study are diverse in terms of the production factors they are equipped with (Table 1). This concerns the area of agricultural land, above all. In group I holdings, the area of farmland was 14.41 ha greater than in group II. Production in both groups was conducted on owned and leased land, however a greater share of leasing was observed in group I holdings (37.2% of farmland area). The high value of the coefficient of variation (147% in group I and 166% in group II) indicates the high diversity of holdings, even within the same group. Fixed assets are also a distinguishing factor, and their value in group I was 50% greater than in group II. Employment data shows that the studied holdings mainly employed family members, and hired labour was only a small supplement to family labour. In group I, employment per 100 ha of farmland amounted to 4.94 full-time workers compared to 7.26 full-time workers in group II. The higher employment in group II holdings, indicating that they are smaller in area, results from the combination of this factor with difficulties on the labour market and the lack of alternative employment for members of the agricultural family. The economic size of holdings, determined based on standard production, is the consequence of the diversity of production factors. In the Community Typology for Agricultural Holdings, group I holdings are classified as medium-large and group II holdings as medium-small.

Crop structure is a basic determinant of the organization of plant production. It is decisive to the production and economic effects, besides the level of fertilization and harvested crops. The share of cereals in the crop structure of the studied holdings was very high – nearly 80% in group I and over 80% in group II (Table 2). Assessment of the organization of plant production based

**Table 1.** Selected characteristics of surveyed agricultural holdings (2011–2012)  
**Tabela 1.** Wybrane charakterystyki badanych gospodarstw rolnych (2011–2012)

Specification Wyszczególnienie	Descriptive statistics – Statystyki opisowe			
	average średnia	median mediana	standard deviation odchylenie standardowe	coefficient of variability współczynnik zmienności (%)
Group I – Grupa I				
Economic size (EUR) Wielkość ekonomiczna (euro)	53 239	39 352	43 829	82.32
Utilised Agricultural Area (ha) Powierzchnia UR (ha)	41.55	32.59	31.29	75.30
including rented UAA <sup>1</sup> (ha) w tym powierzchnia dzierżawionych UR (ha)	15.48	8.97	22.76	147.02
Total labour input (AWU <sup>2</sup> ) Zatrudnienie ogółem (AWU <sup>2</sup> )	2.05	2.00	0.63	30.87
Family labour input (FWU <sup>3</sup> ) Zatrudnienie własne rodziny (FWU <sup>3</sup> )	1.94	2.00	0.47	24.34
Fixed assets (thous. PLN) Aktywa trwałe (tys. zł)	945.7	762.6	731.7	77.37
Group II – Grupa II				
Economic size (EUR) Wielkość ekonomiczna (euro)	36 101	28 305	32 150	92.11
Utilised Agricultural Area (ha) Powierzchnia UR (ha)	27.14	24.93	21.79	56.98
including rented UAA <sup>1</sup> (ha) w tym powierzchnia dzierżawionych UR (ha)	7.55	4.20	16.02	166.07
Total labour input (AWU <sup>2</sup> ) Zatrudnienie ogółem (AWU <sup>2</sup> )	1.97	1.92	0.64	33.53
Family labour input (FWU <sup>3</sup> ) Zatrudnienie własne rodziny (FWU <sup>3</sup> )	1.91	1.89	0.47	25.74
Fixed assets (thous. PLN) Aktywa trwałe (tys. zł)	628.2	434.7	328.4	63.91

<sup>1</sup> Utilised agricultural area – Powierzchnia użytków rolnych.

<sup>2</sup> Annual Work Unit – Jednostka przeliczeniowa pracy.

<sup>3</sup> Family Work Unit – Jednostka przeliczeniowa pracy członków rodziny.

Source: own calculations.

Źródło: obliczenia własne.

on crop structure yielded unfavorable results. According to the principles of good agricultural practice, the share of cereals in the crop structure should not exceed 66% (Duer et al., 2002), but it was much higher in both groups (Table 2). In such cases, the ecological equilibrium of agrocoenoses is violated.

Cereal mixtures were dominant in cereal crops (39% on average in group I and 48% in group II), which have relatively good yield under the conditions present in the Podlaskie voivodeship. The share of triticale crop area was also high – this is a cereal with good qualities as feed. Together with cereal mixtures also intended

**Table 2.** Selected characteristics of the organization of production (2011–2012)  
**Tabela 2.** Wybrane charakterystyki organizacji produkcji (2011–2012)

Specification – Wyszczególnienie	Group I – Grupa I		Group II – Grupa II	
	2011	2012	2011	2012
Cereals – Zboża (%)	79.2	78.4	82.3	82.3
Fodder – Pastewne (%)	17.0	17.7	14.5	14.9
Industrial crops – Przemysłowe (%)	2.7	3.1	1.6	1.3
Potato – Ziemniak (%)	1.1	0.8	1.6	1.4
Total livestock unit (LU) Zwierzęta ogółem (LU)	49.93	53.94	30.33	31.31
including dairy cows w tym krowy mleczne	22.53	23.81	13.59	13.67
Stocking density (LU/ha) Obsada zwierząt (LU/ha)	1.69	1.71	1.45	1.45

Source: own calculations.  
 Źródło: obliczenia własne.

as feed, this share amounted to approx. 70% in both groups. The area of potato crops did not exceed 0.3 ha. The tendency to limit potato crop area has been present for several years due to changes in the livestock feeding system.

In terms of forage plants, a small increase in their crop area occurred in both groups; from 5 ha in 2011 to 5.59 ha in 202 in group I, and from 2.96 ha in 2011 to 3.05 ha in 2012 in group II, where 95% was corn intended for green forage. Such organization of plant production is dictated by the demand for forage. Cattle, including dairy cattle, was dominant in the livestock structure.

Livestock are also linked to environmental restrictions on animal production, which concerns, above all, potential threats resulting from agricultural use of animal excrements. Average stocking density in group II holdings did not pose a threat to the natural environment because it did not exceed the maximum level of 1.5 LU/ha (Duer et al., 2002). Group I holdings posed such threats, because the stocking density significantly exceeded the upper stocking limit that has been accepted in good agricultural practice.

Holdings benefiting from subsidies for supporting investments were characterized by a greater intensity of production (Table 3). They were distinguished by a greater consumption of all production factors, but because of this, they exerted greater pressure on the

environment. In reality, the index of costs sustained for purchasing mineral fertilizers and plant protection products is of limited value in environmental impact assessment, however it can be of diagnostic value and serve as a criterion in trend assessment (Sobczyński, 2008). The average value of production factors in group I was 34% greater than in group II. Changes in the intensity of production over time indicate that a growing burden caused by production factors in both holding groups is being placed on the environment.

In 2011–2012, the studied holdings increases their capital resources, above all. A growing trend in the level of technical infrastructure assisting labor was observed, with 11% growth in group I holdings and only 0.8% growth in group II holdings (Table 4).

In the case of technical infrastructure related to land, this growth was smaller, amounting to 3.3% in group I, and in group II, a small reduction of this index took place in 2012 (by 0.64% compared to 2011) while farmland area increased by 0.26 ha. Besides labor inputs, the fixed assets to total assets ratio is the primary factor differentiating holdings. The greater degree to which holdings realizing investments are equipped with machinery and devices arises from implementation of technical progress, and investment in modern equipment makes it possible to meet sustainable development requirements (Pawlak, 2010).

**Table 3.** Intensity of production in the surveyed farms (2011–2012)

**Tabela 3.** Intensywność produkcji w badanych gospodarstwach (2011–2012)

Specification Wyszczególnienie	Group I – Grupa I		Group II – Grupa II	
	2011	2012	2011	2012
Total intermediate consumption (PLN/ha) Zużycie pośrednie (zł/ha)	4 906.56	5 602.73	3 915.13	4 222.09
Seeds and plants (PLN/ha) Nasiona i sadzeniaki (zł/ha)	134.67	164.60	134.00	143.57
Fertilizers (PLN/ha) Nawozy mineralne (zł/ha)	541.24	666.34	399.63	451.19
Crop protection (PLN/ha) Środki ochrony roślin (zł/ha)	88.37	108.01	67.11	64.16
Feed (PLN/ha) Pasza (zł/ha)	2 664.85	3 071.63	1 986.50	2 150.93
Energy (PLN/ha) Energia (zł/ha)	598.63	640.02	508.88	560.09

Source: own calculations.  
Źródło: obliczenia własne.

**Table 4.** Value of assets (2011–2012)

**Tabela 4.** Wartość aktywów (2011–2012)

Specification Wyszczególnienie	Group I – Grupa I		Group II – Grupa II	
	2011	2012	2011	2012
Total fixed assets (PLN/ha) Aktywa trwałe (zł/ha)	22 408	23 140	18 936	18 814
Total fixed assets (PLN/AWU) Aktywa trwałe (zł/AWU)	445 396	494 525	278 170	280 573
Total current assets (PLN/ha) Aktywa bieżące (zł/ha)	4 719	5 095	4 569	4 656
Total assets (PLN/ha) Aktywa ogółem (zł/ha)	27 128	28 234	23 505	23 470
Total assets (PLN/AWU) Aktywa ogółem (zł/AWU)	531 308	594 575	345 295	350 009
Equity (PLN/ha) Kapitał własny (zł/ha)	23 314	25 045	21 486	21 535
Total liabilities (PLN/ha) Zobowiązania ogółem (zł/ha)	3 141	3 189	2 019	1 935
including long-term liabilities (PLN/ha) w tym długoterminowe (zł/ha)	2 472	2 453	1 642	1 578

Source: own calculations.  
Źródło: obliczenia własne.

The value of current assets increased systematically, by 8% in group I. This growth only amounted to 1.9% in group II, more as a result of rising prices of production factors than the actual growth of production intensity. An increase in the value of owned capital took place in holdings benefiting from subsidies for investments, and in 2012, this value was 7% greater than in 2011, while there was only 0.3% growth in group II holdings.

The share of own capital in financing assets was very high in both groups, equal to 85-88% in group I and over 91% in group II, thus liabilities made up a small share. The average indebtedness of group I holdings was over twice as high as that of group II holdings. The differences are smaller when indebtedness per 1 ha of farmland is taken into consideration, which results from farming intensity. Long-term liabilities were dominant in the debt structure as a result of taken loans related to investment activity. The involvement of own equity in

the realization of investment projects is a problem even for economically strong holdings. This is why credit is a significant foreign source of financing for development, although it is not available to many holdings due to their low credit rating. Larger and economically strong holdings exhibit greater activity in acquiring public funds for realization of investments. This pertains to both EU and national instruments, including preferential credit, above all. Preferential credit was the basic external source of financing for holdings in both groups, while only holdings in group I benefited from subsidies for investments. Thus, one can hypothesize that the greater activity of owners of holdings in this group is the result of experience gained previously as well as greater entrepreneurship of farmers (Pietrzykowski and Wicki, 2011).

Growth of the value of fixed assets in a holding is generally related to improvement of the use of owned

**Table 5.** Production and economic results (2011–2012)  
**Tabela 5.** Wyniki produkcyjno-ekonomiczne (2011–2012)

Specification – Wyszczególnienie	Group I – Grupa I		Group II – Grupa II	
	2011	2012	2011	2012
Production value (PLN/ha) Wartość produkcji (zł/ha)	8 638	9 244	7 031	7 066
crop production (PLN/ha) produkcja roślinna (zł/ha)	1 891	2 120	1 725	1 528
animal production (PLN/ha) produkcja zwierzęca (zł/ha)	6 722	7 794	5 279	5 507
Net value added (PLN/AWU) Wartość dodana netto (zł/AWU)	34 609	35 641	27 351	24 799
Family farm income (PLN/ha) Dochód z rodzinnego gospodarstwa rolnego (zł/ha)	3 809	3 571	3 307	2 939
Family farm income (PLN/100 PLN total fixed assets) Dochód z rodzinnego gospodarstwa rolnego (zł/100 zł środków trwałych)	16.99	15.43	14.07	12.52
Family farm income (PLN/FWU) Dochód z rodzinnego gospodarstwa rolnego (zł/FWU)	78 473	80 189	48 360	43 467
Family farm income in relation to the net salary in the national economy (PLN/FWU) Dochód z rodzinnego gospodarstwa rolnego w relacji do wynagrodzenia netto w gospodarce narodowej (zł/FWU)	1.38	1.38	0.94	0.84

Source: own calculations.  
Źródło: obliczenia własne.

property, which is the source of income growth. Profitability of land, profitability of labour, and profitability of fixed assets are among the basic indexes of economic effectiveness, because they determine the degree in which basic production factors are used. The income of a holding changes depending on, above all, production value and sustained costs. Group I holdings achieved a higher production value. In their case, greater increases of production value per 1 ha of farmland was also observed (by 7% in 2012) while this growth amounted to 0.5% in group II holdings.

Livestock production had the greatest impact on production value in both groups, making up nearly 80% of this value (Table 5).

Holdings achieved more favourable results in 2011, and in 2012, the value of most economic indexes decreased due to deterioration of production conditions, and this particularly applies to group II holdings (Table 5). In group I holdings, two indexes had a lower value: income per unit of area and income per PLN 100 of fixed assets. The lower level of income per 1 ha of farmland is probably the result of a slight increase in farmland area, and the poorer effectiveness of fixed assets is the result of a high degree of technical infrastructure for the land and labour, which generates high fixed costs and reduces effectiveness.

In group I, income from an agricultural holding per family member employed full time was relatively high and was maintained at 138% parity income despite deterioration of production conditions. The income to parity level index was unfavourable in group II holdings. In 2011, the value of income per family member employed full time was 94% of parity income, and in 2012, there was further reduction and this index amounted to only 84%.

## CONCLUSION

Modernization of the equipment and building competitive potential are conditions for the preservation of agricultural holdings on the market. The investment they require is a key issue. The primary source of funds for development of holdings are farmers' incomes, and their level determines farmers' inclination to investment. However, state aid is required to initiate the development process. The instruments of agricultural policy play such a role. The stream of funds from these instruments that can be applied to agricultural holdings is very

broad, and utilization of these funds mainly depends on the activity of the farmers themselves in acquiring and making use of these funds. Public funds, whether in the form of subsidized loans or subsidies, make it possible for new technologies to be introduced more rapidly. The introduction of new technologies makes it possible for production capabilities to grow. However, this model of development encounters barriers arising from environmental limitations.

Analysis of agricultural holdings making investments subsidized by public funds indicates the strengthening of such entities in terms of both production potential and effectiveness of management (farming). In 2011–2012, they achieved income per family member employed full time above parity income. These holdings are characterized by a greater production intensity and achieve high economic results but also exert a greater pressure on the environment. The main threats to the environment are related to excessive stocking density. The owners of these holdings are faced with the important task of reconciling economic objectives with respect to the principles of the environmental protection, particularly since subsidization of agricultural holdings with EU funds is contingent upon the achievement of environmental objectives in agricultural activity.

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## ORGANIZACJA I WYNIKI GOSPODARSTW ROLNYCH REALIZUJĄCYCH INWESTYCJE Z UDZIAŁEM ŚRODKÓW PUBLICZNYCH

**Streszczenie.** W artykule podjęto próbę oceny organizacji produkcji i wyników ekonomicznych gospodarstw rolnych, które realizowały inwestycje z udziałem środków publicznych w aspekcie zasad dobrej praktyki rolniczej. Badaniami objęto gospodarstwa rolne województwa podlaskiego będące w systemie FADN w latach 2011–2012. W ocenie uwzględniono strukturę zasiewów, obsadę zwierząt, intensywność produkcji, wartość i strukturę kapitału oraz dochodowość ziemi, kapitału i pracy. Analiza wykazała, że gospodarstwa korzystające ze wsparcia inwestycji środkami publicznymi charakteryzowały się wyższą intensywnością produkcji, osiągały też lepsze wyniki ekonomiczne. Wywierały one jednak większą presję na środowisko i stwarzały zagrożenia wynikające głównie z dużej obsady zwierząt.

**Słowa kluczowe:** gospodarstwo rolne, inwestycje, środki publiczne, organizacja, dochód

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